212-02: GOALS FOR INDUSTRIAL LAND USE

02-01: Introduction

From Rhode Island's *Economic Development Strategy* ((2)) come the following goals, underscoring the need to reserve sufficient land of adequate quality for industrial expansion:

- *Diversify the industrial base.* "Capitalize on the wide range of the state's resources to build an industrial base..."

- *Promote "urban industry."* "Relate industrial development to overall land use...and general industrial development in accord with sound land use policy."

- *Provide optimal infrastructure.* "Transportation, utilities, goods, water, energy, and waste processing..." ((2:3.7-3.9))

With the state's limited land resources, it is becoming increasingly difficult to find "ideal" parcels of land — with no constraints to development, and having a full suite of amenities, including water, sewer, gas, and rail access — for industrial expansion. Some industrial parks have reached capacity, or cater to specialized firms and exclude others. Older parcels may have the amenities, but some have a questionable environmental legacy or an obsolete configuration. This is not to say that Rhode Island lacks developable sites, but it does suggest that we need to re-define what is meant by the "ideal" site.

The planner's desire is to match the plant with the land, that is, to determine what the plant requires of the land to operate efficiently, and to see whether a company is willing to forgo an amenity absent from a site to take advantage of other favorable aspects. The definition of "ideal" thus becomes relative. A company may be willing to engineer its own wastewater treatment, for example, to locate a plant in an unsewered area that has good highway access or a cheap and convenient energy supply.

It is also the planner's desire to maintain Rhode Island's quality of life, which itself is a magnet for economic development. Polls of executives responsible for corporate location decisions frequently cite quality of life as a determining factor. Our state's beaches, quaint villages, sailing activities and other recreational opportunities all bespeak a high quality of life that has been protected by land use policies. While these features are certainly not unique to Rhode Island, what sets us apart from the rest of the country is that they are all accessible within a small geographic area. Tourism boosters are not bashful about promoting this aspect of the state. But a balance must be struck between development and potentially competing uses. Growth and conservation are *both* essential to the Rhode Island economy.

The Statewide Planning Program has attempted to strike this balance in *Land Use 2010: State Land Use Policies and Plan* and the *Economic Development Policies and Plan* (which has superseded the *Economic Development Strategy*).

02-02: Goals of *Land Use 2010*

The overall goal of *Land Use 2010* is taken directly from a 1978 Act of the Rhode Island General Assembly, "State Environmental Rights" (R.I.G.L. 10-20):

> ...[T]o create and maintain within the State of Rhode Island conditions under which man [sic] and nature can exist in productive harmony in order that present and future generations may enjoy clean air and water, productive land, and other natural resources with which this state has been endowed.

As *Land Use 2010* observes, "Very similar statements are contained in numerous legislative acts and in the Constitution of the State of Rhode Island and Providence Plantations... It is considered a consensus goal to which the people of Rhode Island have been and remain committed." ((3:2.1)) Indeed, the goal is an elegant restatement of the need to preserve the state's quality of life, while taking advantage of its "productive land."

Land Use 2010 advances other goals specific to population growth, land use, and environmental protection:

- Relate state land use policies to anticipated population growth in a manner that will maintain or enhance the distinction between urban and rural, and inland and shore environments.

- Facilitate land use and development that will sustain and promote economic growth consistent with the state's characteristics and environmental objectives.

- Guide the development of land and water to produce a healthful, efficient, and esthetically pleasing environment.

Land Use 2010 frames these goals and captures the essence of the land preservation problem by recognizing the need for "attractive industrial acreage" that is protected from being "gradually lost to residential and other purposes." At the same time, the plan cautions against having land that would be more appropriate for agriculture, open space, or recreation slip into an industrial or commercial use unsuitable for the location. The examples of prime farm soils and coastal areas are cited. ((3:2.3-2.4))

Land Use 2010 concludes that "[i]ndustrial and commercial development must occur in a manner consistent with regional resources and land uses in order to protect their own interests, and so that undesirable side effects will not outweigh the economic benefits for which they were sought." ((3:2.3-2.4))

02-03: The *Economic Development Policies and Plan*

The *Economic Development Policies and Plan* (*EDPP*) is more focused on the creation and sustenance of "wealth for the people of the state" than on land use, but its goals and policies are consistent with those of *Land Use 2010.* Both call for the revitalization of central cities, for example, and for industrial development in accord with sound land use policy. The *EDPP* responds to the "need for a clearly defined and specific state economic development goal for which policies and action programs can be formulated" ((2:3.12)), within the framework of the State Guide Plan, in similar fashion to the earlier *Economic Development Strategy*.

Upon examination of the policies proposed in the *EDPP* one notices obvious connections with *Land Use 2010.* Consider first the goal of the *EDPP,* and then the objectives that form umbrellas for each set of policies:

- *Goal:* Foster and maintain a vigorous economy able to provide an adequate number and variety of activities that generate wealth for the people of the state. ((102:3.1))

- *Objective A, Employment:* Provide at least 34,200 new employment opportunities for Rhode Island residents, achieving and maintaining full employment and reducing underemployment. ((102:3.2))

- *Objective B, Facilities:* Work with economic development practitioners to encourage sustainable industrial and commercial development that advances the long-term economic and environmental well-being of the state, and is consistent with…other applicable elements of the State Guide Plan. ((103:3.3))

- *Objective C, Climate:* Maintain a business environment conducive to the birth, sustenance, and growth of suitable industry and commerce. ((102:3.5))

Now consider some of the policies, first under Objective A, Employment:

- Promote and develop the use of public transit so as to eliminate spatial barriers to employment opportunities. Encourage development in densities high enough to facilitate the economic provision of mass transit.

- Encourage communities to plan for and to accommodate the socioeconomic impacts of industrial and commercial development, such by providing a variety of housing options to meet the needs of the local labor force. ((102:3.2))

Under Objective B, Facilities:

- Reclaim brownfields by environmental remediation and encourage use of the "built environment."

- Conserve and enhance desirable existing industrial areas, office complexes, and concentrations of service activities so as to maximize the investment and utilization of existing infrastructure. New or expanded public sewer and water services and highways should be provided to industrial and commercial development only where such development is appropriate in terms of the natural constraints imposed by the land, air, and water in the immediate vicinity of such development…

- Encourage higher densities, mixed uses, careful design, transit- and pedestrian-friendly land use and development patterns, and location near existing hubs and corridors to avoid "sprawl."

- Relate industrial and commercial development to overall land use by promoting the use of development controls and performance standards that mitigate conflicts with other land uses and activities.

- Encourage investment by the public and private sectors that will stabilize and improve housing and commerce in deteriorating urban areas.

- Contribute to the stabilization and redevelopment of central business districts through the provision of supporting services such as transportation access, parking, utilities, and police and fire protection, as well as the adaptive reuse of historic buildings…

- Select locations [for industrial and commercial development]… consistent with the general development patterns set forth in the state land use policies and plan element and with all other applicable elements or provisions of the State Guide Plan…[and] compatible with the scale, historic character, and other aspects of the surrounding community. ((102:3.3-3.4))

Finally, Objective C, Climate:

- Encourage reservation of prime industrial sites through protective regulation or acquisition, recognizing the importance of factors such as topography and soil characteristics, availability of water and sewer service, access to transportation facilities, proximity to water bodies, and availability of labor.

- Maintain public infrastructure, both structural (physical) and non-structural (social). Provide additional infrastructure when it is clearly demonstrated as necessary, and in a manner that will protect the long-term health of the state's natural and fiscal resources. ((102: 3.5))

There are recurring themes in this list of policies: fitting the industrial activity to the land, rather than *vice versa;* reusing underutilized and perhaps deteriorating resources in the central cities; and providing new infrastructure, primarily public water

and sewer service, where such amenities are absent, only if the improvements would "not promote wasteful use of resources."

Amplifying *Land Use 2010,* the *Economic Development Policies and Plan* provides an excellent starting point for the *Industrial Land Use Plan.*

02-04: How Much Industrial Land Do We Need?

Planners base land use projections on workforce projections, employment densities, and the anticipated kind of industrial activity. Table 212-02(1) demonstrates one method of doing this.

First, Rhode Island's private-sector industries were broken down into six groups: construction, manufacturing, transportation/communications/utilities, wholesale trade, finance/insurance/real estate (FIRE), and services. All these groups occupy industrial land, though in varying proportions. Some would be restricted to industrial zones, while others might be found in commercial or other zones as well.

Second, employment in each group was projected for the year 2020. This was based on employment figures for 1975, 1980, 1985, 1990, and 1995 that were subjected to a regression analysis to detect trends (increases or decreases) over a 15-year period. These trends were presumed to continue until 2020. The methodology is fully explained in Section 04-03-01 of this plan (p. 4.3).

Third, each group's share of Rhode Island's industrial-zoned land was entered into the table. Where "100" appears in this column, it was anticipated that all (100 percent) of the employment in that group would be sited on industrial land. Numbers less than 100 indicate that some or most of the employment was expected to be sited on industrial land, and the remainder in commercial or other zones. These proportions were based on the tendency of certain industries (such as business services) to locate in commercial or mixed residential areas as well as industrial zones.

Fourth, employment in industrial-zoned areas was calculated for each group by multiplying the workforce projection in the second column by the industrial land share in the third. This figure in turn was multiplied by the average employment density of each group (fifth column) to derive an estimate of each group's required industrial acreage (column six).

This method brings more detail into land use projections than the use of a cross-industry employment density (see page 1.2). However, even though it examines industry groups individually, it still is dealing with *average* densities and *average* land requirements within each group. Real-life situations with individual firms may deviate from the calculated "norm." On the other hand, the method is very useful for a broad, statewide approach.

Table 212-02(1) indicates that, in 2020, Rhode Island will need 13,607 acres of industrial land to site 260,151 private-sector employees. The cross-industry employment density on page 1.2 yielded an estimate of 17,343 acres. The

discrepancy may be due to the updated employment estimates used in Table 212-02(1). In 1975, when the cross-industry average of 15 was determined, manufacturing accounted for most employment. Today, service industries of higher employment densities predominate. This change would move the cross-industry average upward, resulting in fewer acres needed to accommodate the total workforce.

In addition, factoring in employment density averages from each industry group corrects somewhat for wide deviations from a cross-industry average that are seen in some of the groups. Witness wholesale trade, for example, at six employees per acre, and FIRE, at 125 employees per acre. ((5))

Whether talking 13,607 acres or 17,343 acres, planners must eventually inquire as to the availability of on-site public water, sewers, electricity, gas, and rail access, and investigate constraints such as wetlands, unfavorable topography, or unmarketable size or configuration. The reality is that many acres will fall short of their ideal. Just as important, some "industrial" sites will be occupied by other uses.

TABLE 212-02(1):
INDUSTRIAL ACREAGE PROJECTIONS: YEAR 2020

Industry	Employment 2020	Industrial Land Share (%)	Employment in Industrial Areas	Employment Density (Per Acre)[1]	Required Acreage
Construction	21,576	100	21576	5	4,315
Manufacturing	49,227	100	49,227	20	2,461
Transportation	12,526	100	12,526	10	1,253
Communication	3,013	75	2,260	40	57
Utilities	2,362	100	2,362	30	79
Wholesale	24,849	75	18,637	6[2]	3,106
FIRE	34,556	50	17,278	125[3]	138
Services	227,142	60	136,285	62[4]	2,198
TOTAL	**375,251**		**260,151**		**13,607**

1 Statewide Planning estimate unless otherwise indicated.
2 From Gruen Gruen & Associates estimate. ((5))
3 Estimate for "office" workers. ((5))
4 Estimate for "health care" workers ((5)), health services being the largest component of services through 2020.

Will the state have 13,607 acres available to support industrial employment projections in 2020? Table 212-02(2) takes a look at what is available at present in light of projected needs for the next century. This table draws on state and local sources for the inventory of industrial land prepared as part of this *Industrial Land Use Plan.*

In 1999, there were 32,455 acres zoned for industry statewide. Accepting the 13,607-acre forecast, that would appear to offer a surplus of 21,480 industrial acres — a comfortable margin. It is incorrect to assume this for several reasons. First, not all industrial-zoned land is in industrial use. In 1999, 6,113 acres of industrial land were used for commercial or residential purposes. This left 26,342 acres to sustain present and future industrial activity. Second, among these acres, there were 15,224 that were vacant (undeveloped), but only 1,485 that had the infrastructure and physiographic attributes (favorable soils and topography) to be considered "prime." Finally, industrial zoning at present does not automatically preclude non-industrial uses in the future, through rezoning. Rhode Island's industrial acreage has not remained constant over the years. In 1988, the total was 35,186 acres.

Moreover, some prime sites that would ordinarily be considered leading candidates for future industrial development may be burdened by lingering environmental problems due to previous use. Wherever industrial properties are contaminated, or suspected of being contaminated, questions arise about responsibility for cleanup and liabilities being transferred from previous owners. Industrial-zoned sites that truly are construction-ready become few and far between.

TABLE 212-02(2):
INDUSTRIAL USE *vs.* INDUSTRIAL ACREAGE

Acreage zoned industrial, statewide [1]	32,455
Industrial acreage in uses other than industrial [1]	6,113
Industrial acreage remaining for industrial use [1]	26,342
Projection of required industrial acreage in 2020	13,607
Industrial acreage already committed to industrial use (1999) [1]	11,116
Industrial acreage needed for expansion of industrial use in 2020	2,491
Vacant (undeveloped) industrial acreage [1]	15,224
Vacant ("prime") industrial acreage, w/public water, sewer, no physiographic constraints [1]	1,485
Apparent shortage of prime acreage for industrial use in 2020 [2, 3]	1,006

[1] Statewide Planning Program Industrial Land Inventory, 1997-99.
[2] Prime industrial land is presumed constant for the purposes of this exercise from 1999 to 2020.
[3] Presumes all prime industrial land is construction-ready.

It will be noticed that the projection used in Table 212-02(2) for industrial acreage in 2020 is an increase of about 2,500 acres from what was actually in industrial use in 1999. Considering the trend of growth in industries of higher employment density (services) than existed previously (manufacturing), this suggests a significant expansion in the Rhode Island economy in the next 20 years. Rhode Islanders must be prepared for that expansion and how quickly it will occupy the prime industrial sites we have left. The table suggests there will be a shortage of prime land in 2020 amounting to 1,006 acres.

It is clear that Rhode Island's industrial sites must not be squandered and lost to non-industrial uses; that mixed-use zoning should be considered wherever possible to stretch the resource; that opportunities for more efficient utilization of existing sites should be exploited; and that extension of infrastructure to sites lacking public water or sewers to make them prime should remain on the agenda.

It is critical to remember that the 13,607 acres cited above are the minimum desired for the year 2020, based on our analysis. It is therefore practical to think of a "margin of safety" beyond this minimum to ensure that Rhode Island does indeed have this land available for industrial use in the future. The staff has kept its projections as conservative as possible, and there are limitations to regression analysis (see page 4.4).

Additionally, some of the vacant land listed as prime in Table 212-02(2) may not be practical to develop. There may be individual parcels that are too small or of too odd a shape to be attractive to industry even though those parcels are labeled prime because of the presence of infrastructure and the absence of slope, floodplain, or poorly drained soils. The figure in the table for prime industrial land is a *total*. It considers only the sum of the parts, not the parts themselves, and quantity, not quality.

It must also be remembered that our land use projections are based on average employment densities. Employment densities vary not only from industry group to industry group, but *within* an industry group. Actual densities may be lower than originally anticipated, requiring more space than expected.

Finally, our projections do not and cannot address what the future might hold regarding rezoning, "greenfields" *vs.* "brownfields" development, or requirements for open-space buffers within industrial developments. Nor does it account for employment projections derived from other sources that could differ significantly, not in the trends they portray but in numbers. ((7))

It is clear that *something must be added to our figures to give us the assurance that we will have sufficient industrial land for the future.* Some direction in this is provided by *Land Use 2010,* which recommends adding a reserve of "at least 8,000 acres" to the total of vacant prime industrial land and industrial land currently occupied, with the presumption that the latter will not be surrendered to non-industrial uses in the future.

More than 13,000 acres comprise the pool of vacant, non-prime industrial land that might be considered for upgrading with utilities in the future. However, it is not just a matter of extending infrastructure to make some sites construction-ready. Physiographic constraints exist on 11,032 of those vacant acres – requiring considerable site preparation, and suggesting difficulty in getting permits.

How, then, can Rhode Island planners ensure future access to high-quality industrial land, and where would it come from?

02-05: A Variety of Industrial Settings for the Future

When assessing the need for industrial space, some planners and developers prefer to use ranges of employment density rather than static, average values. Carl H. Buttke of the Institute of Transportation Engineers, for example, has used a "typical land-use density" for all manufacturing of 18.5 employees per acre ((8:28)). Harold Marks of the Transportation Research Board, on the other hand, divides manufacturing into categories, e.g., "highly automated industry" at five employees per acre, or "industrial tracts" at 20 to 100 employees per acre. ((9:112))

An approach similar to Marks' is taken by Donald C. Lochmoeller and his co-authors in their *Industrial Development Handbook* ((10:168)), where they categorize 21 separate manufacturing concerns in a hypothetical community by employment density (labor intensity): *intensive,* at 26 employees per acre; *intermediate extensive,* at 12 per acre; and *extensive,* at six per acre. Lochmoeller's table, which lists the manufacturing types within each of these classes, is reproduced as Table 212-02(3).

Because employment densities vary, there is room for flexibility in matching industrial concerns to industrial settings. For one company, an urban setting might be best; an old mill might be just the thing to renovate, given the number of employees and the nature of the work. For another company in basically the same field but using different technology, that same building might be obsolete. That firm might want to look elsewhere. A good industrial land use plan should set forth policies that accommodate both companies.

02-05-01: Industrial Parks

A very significant addition to the planner's repertoire is the industrial, research, office, or business park. These parks are especially appealing to non-energy-intensive, relatively non-polluting, and high-growth industries, for esthetic reasons and efficient layout. In the case of insurance or business services, proximity to prospective clients, or even the prestige attached to the location, may be a critical siting criterion. ((9)) The possibility also exists for real benefits from commingling different subsidiaries of the same company — administration with research and development, for example.

Industrial parks can accommodate firms with different employment densities. The Howard Industrial Park in Cranston, for example, has among its

TABLE 212-02(3):
"LABOR INTENSITY" OF SELECTED INDUSTRIES

Industry Use Group	Major Industry Group (2- or 3-digit SIC)	Employees per Acre
Intensive (< 200 sq. ft./employee)	Electrical Equipment and Supplies	26
	Transportation Equipment	
	Instruments and Related Products	
	Apparel and Other Textile Products	
	Printing and Publishing	
Intermediate Extensive	Ordnance and Accessories	12
	Lumber and Wood Products	
	Furniture and Primary Fixtures	
	Fabricated Metal Products	
	Industrial and Commercial Machinery	
	Miscellaneous Manufacturing	
	Food and Kindred Products	
	Textile Mill Products	
	Paper and Allied Products	
	Chemicals and Allied Products	
	Rubber and Plastic Products	
Extensive (>1,000 sq. ft./employee)	Stone, Clay, and Glass Products	6
	Tobacco Products	
	Petroleum and Coal Products	
	Leather and Leather Products	
	Wholesale Trade	

Source: Lochmoeller *et al.* (1975) ((10:168))

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tenants companies that vary from three employees per acre (involved in smelting) to 92 employees per acre (involved in jewelers' findings and materials, and lapidary work). The average employment density at Howard is 21 per acre. In other industrial parks around the state, average employment densities range from less than five to 28 employees per acre.

Several Rhode Island industrial parks have mixed tenants, like Howard. Others are 100 percent manufacturing, or, in the case of the Newport Corporate Park in Middletown, 100 percent services. ((11)) Industrial parks have the following characteristics in common:

- Ample off-street parking
- Landscaping to provide small islands of open space
- Few or no constraints to construction
- Low traffic densities relative to downtown areas
- High visibility

These advantages can make an industrial park highly desirable to almost any industrial concern. However, some companies drawn to the attractive suburban

surroundings that characterize many fully serviced industrial parks may not really require all the amenities. Their work may put relatively little demand on the land, perhaps so little that they could just as easily locate in an industrial area in the inner city, on land zoned industrial but not prime, or in an area of mixed use governed by performance standards. The marketing of sites within a park must be tempered by the recognition that these sites, and indeed all prime industrial land, are a finite resource that must be apportioned judiciously. In addition, the construction of new industrial parks must be tempered by "smart growth" considerations that direct future development to existing, underutilized properties – and encourage transportation options other than the automobile, which are not always available in suburban, rural, or "greenfield" situations.

02-05-02: Brownfields

Modern land use policies are built around the concept of *sustainable development*. The redevelopment of *brownfields* is key to sustainable development in Rhode Island. These abandoned or underutilized industrial properties offer the opportunity to optimize the use of existing resources and help prevent the waste of another resource (greenfields, i.e., undeveloped land) that could and should be reserved for future generations. Brownfields typically are fully serviced industrial sites; public water, sewers, and utilities are available. They may not have the immediate cachet of a well-landscaped industrial park, but with proper redevelopment, they can become industrial showplaces of their own.

Statewide Planning has contributed to the efforts of the Northern Rhode Island Economic Development Partnership, the R.I. Department of Environmental Management (DEM), and the R.I. Economic Development Corporation (EDC) to rehabilitate and reuse old mill buildings as commercial and industrial sites. ((12)) Statewide Planning's Economic Development Planning Section was instrumental in drafting legislation to initiate a mill building reuse program that authorizes tax incentives to property owners, tenants, and lenders for the restoration of such facilities. On the environmental side, the DEM launched a remediation program addressing crucial liability issues that were discouraging the lending community from participating.

To date (2000), two pilot programs from the U.S. Environmental Protection Agency (EPA) have been given to the State of Rhode Island for brownfields study and remediation. These have been focused on two old factory sites in Providence that are key parcels in a planned 4.4-mile "greenway" along the watersheds of the Woonasquatucket and Blackstone Rivers. ((76)) This revitalization effort is designed to restore green space and urban amenities along the riverbank and the surrounding neighborhoods of Manton, Hartford, Olneyville, Valley, and Smith Hill, increase recreational opportunities, and stimulate economic development. ((77)) This is but one creative use resulting from the brownfields program.

The complementary mill building reuse program is linked to the state's enterprise zone program, and under the authority of the Enterprise Zone Council. The Council includes representatives of the EDC, the Urban League, and the League of Cities and Towns. It is to the Council that the municipalities go to get these properties

certified to be eligible for state tax incentives. The municipalities contribute to the process by offering property tax breaks, fast-track permitting, technical assistance, and other inducements to redevelopment.

The Council's and DEM's brownfields initiatives are intended to prevent a rush into the greenfields that could form the core of a reserve of industrial land. If successfully reused, brownfields that were formerly dormant and a temptation to vandals and arsonists could resume their contribution to local tax bases and restore employment opportunities in our oldest communities. For these reasons, the mill building reuse program can be a critical component of sustainable development and deserves Rhode Island's support.

02-06: Siting "Light" and "Heavy" Industry

Traditional zoning ordinances may have more than one industrial category, usually broken down into "light industrial" and "heavy industrial" zones. They are distinguished by the impact expected from "light" or "heavy" industry. These distinctions move beyond employment density and the labor intensive or extensive groupings of Lochmoeller *et al.* They deal with the commitment of land to the industrial *process,* not just to the number of workers there.

There are certain industries, as Lochmoeller and his colleagues noted, that "require extensive sites to accommodate a multiplicity of industrial processes[,]... specialized transportation links which frequently include both water and rail access[,]...[and] the availability of natural resources and an adequate power supply." ((10:54)) Examples include primary metals, chemicals, and petroleum. These would fit the general category of heavy industry.

Heavy industry is seen in the huge steel manufacturing complexes of the Midwest, the chemical refineries of New Jersey, and the textile mills of New England. Similar locational factors influence the siting of such enterprises: proximity to workers and suppliers, proven markets, and access to appropriate modes of transportation (highways, railroads, or shipping). Cheap and convenient sources of power also play a role, like hydropower along the Blackstone River. The steel mill, refinery, and textile mill illustrate the single-use, single-corporation relationship in land use. On one tract of industrial land, there is a single factory.

In contrast, light industry "is less tied locationally to raw materials, low utility rates, large pools of labor, and quantities of water for operational purposes." ((13:39)) Light industry can be accommodated in multiple-use industrial parks, alongside warehouses and offices. As researchers at the Urban Land Institute have observed, light industry has "none of the noxious side effects that have limited the location of older heavy industries" in such settings. ((13:39-40))

As industrial processes have changed over the years and generally gotten "cleaner," the distinction between light and heavy industry has blurred. The traditional descriptors in zoning ordinances covering heavy industry's impacts — "noxious," "offensive," and "objectionable" — are now being recognized as obsolete,

vague, and subjective, and more difficult to apply consistently. The single use/single corporation situation is less commonplace, especially in the mill buildings. Modern zoning is adapting by an increasing reliance on *performance standards* in industrial siting. Performance standards, ideally, will classify industries according to *quantifiable* environmental impact and fashion prohibitions accordingly. ((14:1)) Being based on quantifiable terms, the standards can be consistent, replicable, and equitable.

There will always be industries which, like the sprawling steel mill, will not be able to fit anywhere but in an area set aside for heavy industry. Our definition of "heavy" will be modified, however, by performance standards. Through performance standards an estimate of the degree of "heaviness" in an industry can be ascertained. Performance standards may even permit some commingling of lighter uses with heavy industry — something that would not ordinarily be allowed under a permitted/prohibited use list system of zoning — if the numbers show that conflicts will be minimal. Performance standards can thus play a very important role in securing the most efficient use possible of industrial-zoned land.

It is critical, however, that planners have sufficient confidence in performance standards to begin phasing out their old use lists. As the following section explains, compliance must be adequately monitored for that to happen.

02-06-01: Performance Standards in Rhode Island

Rhode Island's Zoning Enabling Act (*R.I.G.L.* 45-24-27 *et seq.*) granted the cities and towns the legal status to use performance standards in zoning ordinances. ((14:1)) Performance standards are similar in most communities. Typically, they cover smoke, particulate matter, odor, toxic matter, noise, vibration, fire hazards, heat, glare, waste discharges, and radiation. Industries are encouraged to conform to performance standards because the reward for conformance is a greater flexibility in the choice of sites, as long as the standards can be met. ((14:2))

Planners need to recognize that, in practice, performance standards have not yet reached their full potential in Rhode Island. Even communities with performance standards tend to use them in tandem with their old use lists, and occasionally grant special exceptions that are in direct conflict with the principles behind performance standards. In addition, performance standards may cite outdated regulations and obsolete or otherwise incorrect agencies. They may not cite technical sources for the standards. They may not address an adequate range of impacts, nor be kept sufficiently up-to-date to be effective. (On this score, it is interesting to note that in many cases performance standards are not updated when zoning ordinances are amended.) ((14:18-19))

A 1992 study of performance standards done by the Statewide Planning Program observed that regular monitoring of industries to gauge compliance with performance standards is virtually non-existent. Among the Rhode Island cities and towns interviewed, a lack of trained staff and equipment was the single most common problem associated with monitoring. Monitoring is often triggered by complaints from nearby residents rather than done proactively and routinely, and state agencies or engineering firms are called in to do the job. Some municipalities

have implemented self-monitoring, but that entails the usual problems with self-policing: suspicions that the reports are slanted to make companies "look good," equipment that is tampered with, and a dearth of comprehensive reporting. ((14:20))

The same report did endorse the concept of performance standards, and so contained recommendations for improvement. These included having communities conduct a periodic review of their performance standards to ensure that they reflect current regulations and technology, aided by a special standards commission and by regular contact with relevant federal and state agencies, such as the DEM. The report suggested addressing a broader range of possible impacts, such as soil erosion, electrical interference, and stormwater runoff.

The report also recommended a phase-out of the old use lists, and their replacement with criteria and development standards that were more compatible in principle with performance standards. Among these criteria were employment density, size of buildings, type of industrial process, type of machinery, and intensity of land use. The development standards included setbacks, buffers, and landscaping. ((14:21))

02-07: Commingling and Clustering Industries

Commingling works best with related industries. One company may provide materials that are essential to the manufacturing of a product of another company, or be the second company's research and development arm. A third company might be the trucking outfit that links the first tow companies with markets in nearby metropolitan areas. A fourth company might provide computer consulting or inventory management. The possibilities for cooperation among these firms could manifest themselves in business incubators if start-up companies are involved, or in specialized "technology parks" or business parks where one type of good or service is produced. Cooperation may extend into training, technology transfer, and marketing.

Industry clustering takes commingling a step further. Clustering is more specialized in that it involves cooperation among would-be competitors within a single industry. Clusters may take in only one Standard Industrial Classification (SIC) group, or can be spread more broadly, depending on the nature of the industry. The production process, or means of providing their service, will govern the cluster's development.

Factors supporting clustering include the capacity for research and development, compatible workforce skills, proximity to suppliers, access to specialized services, intensity of networking, social infrastructure, entrepreneurial energy, and a shared vision. ((15:24)) Clustering can enable participants to achieve economies of scale essential to production by aggregating purchasing power for raw materials, rationalizing the manufacturing process, and marketing products in common.

The R.I. Economic Policy Council recently identified nine key industrial sectors that might be expected to form clusters easily and distinctly benefit from them. These industries included "mature" sectors that have been losing jobs lately as well as

newer, more "high-tech" examples, in manufacturing as well as services. Jewelry (SIC 391, 395, 396) and boat building (SIC 3732) were included; also electronics and instruments (SIC 357, 362, 366, 367, 369, 38), software (SIC 737, 8711), tourism (SIC 45, 58, 70, 79, 84), precision metalworking (SIC 349, 354, 355, 356, 359), seafood products (SIC 0273, 091, 0921, 2091, 2092, 5146), financial services (SIC 60, 63, 67), and biomedical industries (scattered SIC groups, taking in manufacturing, research, and service provision). ((15:23-24))

Interestingly, there are firms that do not cluster for the same reasons the industries described above do, but form associations with nearby research institutions — resulting in what the Economic Policy Council calls *incubation clusters.* These too can result in considerable economic activity and industry growth. The medical instruments industry in Minneapolis, for example, grew out of spinoffs from a manufacturer of cardiac pacemakers and the University of Minnesota Medical School. ((15:23))

Most Rhode Islanders are familiar with the Jewelry District in Providence and the concentration of recreational boat building in the East Bay. As in any cluster scenario, the proximity of leading actors and players to each other is critical for the desired synergy to occur. If industrial land can be properly assembled where clusters are developing, and development of the participating industries can be focused there rather than scattered around the state, there will be an enormous benefit to Rhode Island. This will not only be the economic benefit to the companies resulting from their clusters, but the benefit of more proactive land use management than ever before.

It is while assembling such industrial parcels for an anticipated industrial, business, or technology park that developers need to ask themselves the following questions:

- Will the park's location and configuration lend themselves to commingling and clustering? If an incubation cluster is anticipated, will the park be close enough to likely business partners, research centers, or product markets?

- Are the target industries looking to expand their operations in the area, so that they will be interested in locating in the park?

- Can the park be supported in the local economy, considering prevailing rents, the cost of energy, and the character and intensity of competition?

- Particularly in the case of a specialized facility such as a research park, can the intended use be sustained, even during economic downturns?

- Will the terms of the park covenant be consistent with zoning and environmental regulations?

This process requires the usual market study, but also consultation with state and local authorities as well as prospective clients. Planners may contribute during the earliest stages of development through site plan review and by assisting developers with the park covenants to ensure consistency with state and local

ordinances. These contacts should be maintained after the park is built, occupied, and running successfully. Improvements to the park will be required periodically, whether in response to the changing needs of the tenants or to new regulations. ((11))

02-07-01: Commingling Inputs and Outputs: the Eco-industrial Park

As the concept of sustainable development matures, it will probably become feasible to commingle industries not just around a single product or service, but to optimize production efficiency and eliminate, or at least greatly reduce, industrial waste. This is the principle behind the *eco-industrial park.*

An eco-industrial park is a true sustainable development system. Firms in the park are encouraged to manage the park's environment and energy resources cooperatively, with components of the waste stream of one tenant being used as raw material for another. "Probably the best example of an eco-industrial park," wrote commentator David Salvesen in 1996, "lies along the coast of Denmark, in an industrial region called Kalundborg." The park, he explained, involved a web of waste and energy exchanges between and among the city, a refinery, a power plant, a fish farm, a pharmaceutical manufacturer, and a wallboard maker.

> The exchange works something like this: the power company pipes residual steam to the refinery and, in exchange, receives gas (which used to be flared as waste). The power plant burns the refinery gas to generate electricity and steam. It also sends excess steam to a fish farm, the city, and a biotechnology plant that makes pharmaceuticals. Sludge from the fish farm and pharmaceutical processes becomes fertilizer for nearby farms. Surplus yeast from the biotechnology plant's production of insulin is shipped to farmers for pig food. Further, a cement company uses fly ash from the power plant, while gypsum produced by the power plant's desulfurization process goes to a company that produces gypsum wallboard. Finally, sulfur generated by the refinery's desulfurization process is used by a sulfuric acid manufacturer. ((16))

Salvesen noted that these different enterprises came together voluntarily to help reduce waste treatment and disposal costs. They soon realized further savings from the efficiencies of planned and organized material and energy exchanges.

A broad-based acceptance of sustainable development is needed for business, civic, and government leaders to embrace eco-industrial parks. The best way to instill support may be to promote eco-industrial parks as a means of reducing waste streams that are expensive to treat. The concept could be introduced at a public workshop on sustainable development, beginning with the basics, showing examples already prevalent in Rhode Island (e.g., the recycling of trash, and rehabilitated and reused mill buildings), and moving on to more advanced concepts such as coordinating inputs and outputs in eco-industrial parks. The state's business community should be afforded an opportunity to learn from the experiences of colleagues from other parts of the country or world who have experimented successfully with eco-industrial parks. ((17))

02-08: Business Incubators

A business incubator, true to its name, will nourish young enterprises until they are mature enough to make it on their own — whereupon they will "graduate" and set up shop elsewhere. Nourishment comes from sharing building space, equipment, and even clerical staff, with significant cost savings realized from pooling resources. Money is "freed" for pursuits other than administrative costs in this cooperative environment. As development capital typically is a problem for new and strongly entrepreneurial businesses, a business incubator could prove crucial to their survival.

Incubators may be situated on university campuses, in industrial parks, in urban industrial centers, or in inner-city neighborhoods. Typically, a minimum of 15,000 sq. ft. of usable space is needed to permit some expansion as the incubator tenants mature, and to achieve economies of scale in administrative cost. ((18:25)) Incubators have the potential to revive economically depressed areas by promoting local and minority-owned businesses an by generating new jobs in new industries. Volunteered consulting services, export promotion, and opportunities for venture capitalization and technology transfer can enhance the incubator's business environment.

One of the most extensive studies of incubators dates back to 1988 and the work of Candace Campbell and her associates. While touting incubators as "a logical and efficient approach to support new enterprises," they warned about placing too much reliance on incubators for *job creation* in such firms. ((19:3)) Employment was higher in incubator firms that sold to large, local corporations and governments and had developed substantial market experience — and therefore were ready to leave the incubator — than in the businesses that were just starting and were still rather dependent on the incubator environment. ((19:6)) When significant job generation does come to an incubator firm, it is usually after the firm has left the incubator and established itself on the outside. In other words, it does not happen immediately. ((20:14))

What business incubators do best, then, is to help start-ups survive until they are ready to stand on their own. From the experience of the incubator, start-ups can also learn the value of inter- and intra-industry collaboration, which seems to be essential to the development of the New Economy.

David N. Allen and Janet Hendrickson-Smith of Pennsylvania State University urge "a different calculus from just counting jobs" to measure an incubator's success. They suggest looking at certain "incubator milestones" instead:

- Completion of initial tenant space.
- Arrangement of shared office services.
- Reaching the occupancy level necessary for the incubator to break even financially.
- Creation of a responsive business assistance network.

- Development of interfirm trade relations.
- Graduation of the incubator's first tenant.
- Admission of primarily new ventures, not relocated, previously established firms.
- Expansion into new, larger quarters to accommodate new or expanding tenants. ((18:29-30))

These milestones, they said, "do not always occur in a sequential order, but for the incubator to make a contribution, each milestone must be eventually passed." ((18:30)) Sharing office services and networking are particularly important in fostering successful industry clusters and joint ventures. The hoped-for job generation should follow.

The relatively small size required for business incubators makes them ideally suited to renovated buildings in urban industrial areas, such as Rhode Island's old mills. Allen and Hendrickson-Smith found that in nine of the twelve cases they studied, the initial idea for the incubator came out of "the desire to do something productive" with "an old building in a state of moderate disrepair." ((18:7)) On the other hand, the costs of renovation and maintenance of such a building should not be so high that the owners and managers of the incubator are forced to charge high rents or to reduce the services they provide. If rents become prohibitive for start-up businesses, the incubator function will suffer, and the incubator may actually cease being an incubator — becoming just another office park, where management is more concerned with real estate than with helping start-ups grow.

Incubators obviously have to be planned carefully to do the job intended. Tenancy must be managed to encourage firms to leave the incubator once their businesses have grown and matured, so that space will become available for new companies. Raising rents after so many years of tenancy is one way of doing this. Fortunately, experience has shown that most tenants understand the purpose of business incubators and accept the notion that eventually they have to move on for the incubator to remain an incubator. ((18:17))

Perhaps one of the most important things by which to gauge incubator performance is its effect on the local business climate. Campbell *et al.* discovered that new companies often won greater acceptance from lenders, investors, and real estate agents by participating in an incubator than by going it alone. The risks in bankrolling research, development, and other phases of start-up, and in providing office and industrial space for fledgling enterprises, seemed fewer when backed by the incubator. The firms gained legitimacy from the incubator. ((19:5))

In 1998, the R.I. General Assembly authorized the establishment of an "urban business incubator" to be located in one of the state's enterprise zones. It was described as "a multi-tenant, mixed-use facility serving companies in a variety of industries including, but not limited to: services, distribution, light manufacturing, or technology-based businesses." A "range of services" would be shared among the tenants, such as "flexible leases, shared office equipment, use of common areas such as conference rooms," and "easily accessible business management, training, financial, legal, accounting, and marketing services" would be directly or indirectly provided. The incubator was to be run as a tax-exempt, non-business corporation. ((89)) In

1999, a group called Urban Ventures established the incubator in South Providence. This is described in detail in Part 212-06, "Implementation Mechanisms," pp. 6.7-6.8.

Experiments with business incubators in Rhode Island bear watching. If the motivating force in the New Economy is the entrepreneur, the services provided to the entrepreneur in an incubator could be key to future economic development.

02-09: Summarized Land Use Goals

From this review of needs and options, and from Rhode Island's experience, an industrial land use plan must encourage the public and private sectors to:

1. *Place sufficient land in reserve to sustain economic growth without compromising the state's quality of life.* Arriving at an appropriate number of acres for this purpose involves forecasting economic activity to the year 2020 and the demands on industrial land this activity will make. The forecast must then be compared with our current inventory of industrial-zoned land. We recommend following the lead of *Land Use 2010* and the original *Industrial Land Use Plan* and reserving land now in industrial use, land that is currently vacant and considered prime, and an additional 8,000 acres from the inventory of vacant but non-prime land, for industrial use in the future. This can be accomplished by discouraging uses incompatible with industry on land that is presently zoned industrial.

   We also should not only consider the quantity of industrial land when we set our goals, but also the quality. We must recognize the need for parcels that are of sufficient size and appropriate configuration to be marketed to industry, as well as serviced with utilities. Keeping the industrial land inventory current is a prerequisite. It is the best means we have of monitoring the use of industrial land and its availability for the future. It is also an important tool for working with the local communities to "match the plant to the land," reuse underutilized industrial properties, track changes in employment densities as the New Economy takes hold, and prevent sprawl or conversion of greenfields.

   Where possible, land reconfiguration to suit the needs of modern industry should be encouraged wherever it leads to more efficient use of the limited industrial land resource, in harmony with the surrounding environment.

2. *Employ "mixed use" as a strategy for industrial land use wherever economically and environmentally feasible,* using industrial performance standards to commingle related industries while at the same time protecting neighboring uses.

3. *Assure to the maximum extent possible the appropriate use of prime industrial land* by matching an industry's needs to available parcels (what we discussed above as "matching the plant to the land"). An automobile

assembly plant, for example, will require much more than a software development firm.

4. *Promote sustainable development.* Waste control and the appropriate reuse of older industrial facilities can be the cornerstones of a much broader sustainable development program. Rhode Island's recycling program and mill building rehab legislation are excellent first steps; combining elements of both in eco-industrial parks is an exciting possibility that needs to be explored.

   We expect the extension of infrastructure to continue to be necessary to provide construction-ready sites for industrial expansion. However, such improvements should be done judiciously and in full accordance with local comprehensive plans so that development can be reasonably guided and controlled.

5. *Encourage business partnerships that can nurture growing companies with much potential,* strategically locating them wherever the natural tendency of related industries to cluster, network, and synergize is likely to occur.